

# NORTHEAST **SUN**

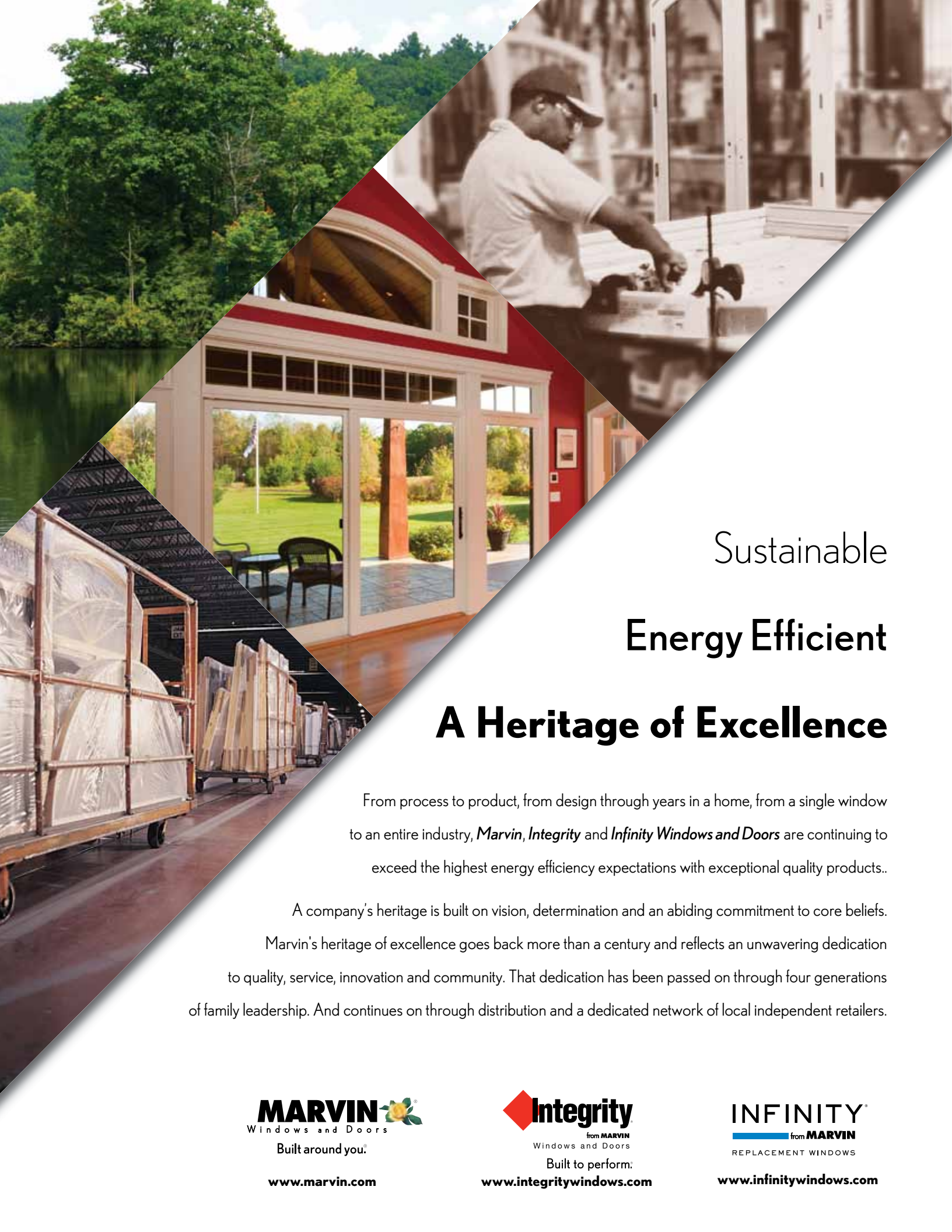
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From landfill to energy hill: In just one of the projects underway in Hamburg, Germany, two wind turbines and a 2.5-acre PV array are going up at a former landfill. "Energy Hill" will supply electricity for about 4,000 households. Landfill gas supplies local industry. Story starts on page 9.

## About NESEA and the *Northeast Sun*

The Northeast Sustainable Energy Association (NESEA) is the region's leading organization of professionals working in sustainable energy, whole systems thinking, and clean technology. We advance the adoption of sustainable energy in the built environment through this magazine (distributed to NESEA members), our annual BuildingEnergy conference and trade show, professional workshops, our annual Green Buildings Open House, and more. A *Northeast Sun* subscription is \$55/year, which includes NESEA membership.

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## Introducing Peer Review



I am really excited about this issue of the *Northeast Sun*. It integrates so well with the content we'll be sharing at the BuildingEnergy12 conference in March, and with the debates brewing within NESEA's community of sustainable energy practitioners. If what you read in this issue excites you too, I'm convinced you'll love the conference. Please join us for BE12, March 6 to 8 at the Seaport World Trade Center in Boston.

I'm also excited to unveil the next new thing "under the sun": our peer review process. Earlier this year, the NESEA board and several NESEA members told me

that the *Northeast Sun* could be a better, more trusted resource for sustainable energy practitioners if we were to introduce some form of peer review into our editorial process. And so we have. The goal: to ensure that the claims made in our articles are accurate and clear, and that the data actually support the conclusions. I also see peer review as a wonderful opportunity to engage more members of our community.

This is a huge milestone for us.

We are learning that NESEA is at its best when its members drive its programs. Right now, this happens best through BE. A committee of 90 volunteer NESEA members plan the content, and the staff provides logistical support to ensure that the conference runs smoothly. How might we replicate some of BE's member-driven energy in the *Northeast Sun*? We believe that peer review may be one answer, and a big part of a new model for the magazine.

And what do we mean by "peer review"? It's an evolving concept, truly an experiment for us—we're starting with just a few articles. But here's what it means for this issue of the *Northeast Sun*:

- **Practical.** Our version of peer review has a very practical focus. It's about a practitioner vetting the content and providing feedback on whether it jibes with his or her experience in the real world.
- **Identified.** Unlike peer review in academia, here, it is not anonymous. At the end of each reviewed article, after the author bio, you'll see who reviewed it.
- **Collegial.** We are mindful of fostering collegiality through the peer review process. NESEA is not the standard-bearer, but rather the place where the important, front-of-the-curve conversations are happening among professionals who conduct themselves as such. Of course, if we receive a submission that our peer reviewer deems so "off the mark" as to threaten NESEA's reputation within the sustainable energy community and the author refuses to make the necessary changes, we reserve the right to not publish the article. But we're not expecting that to be an issue.

Again, our concept of peer review is evolving. We'd love to know what you think it should be. How can we use peer review to continue to improve the *Northeast Sun*? What else would make this publication more useful to you? How can we better help you to advance the adoption of sustainable energy solutions in the built environment? Email me at [jmarrapese@nesea.org](mailto:jmarrapese@nesea.org), or weigh in on our Facebook page or at our blog, at [www.nesea.org](http://www.nesea.org). Thanks!

*Jennifer J. Marrapese*



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## Common Denominators at BE



The power of the BuildingEnergy conference is that people of various disciplines and specialties who have in common a quest to improve the built environment can find each other. Every year, attendees identify qualified collaborators—in addition to learning about the proven and readily available processes, techniques, materials, and technologies they need to achieve their sustainability goals. Indeed, NESEA is clear on its first priority and on its area of reputation and strength: to supply a venue through which people can gather, learn, and then return to work better equipped to succeed.

### **New Health Care and Campus & Community tracks set off BE's broad appeal**

So this year, NESEA and BE12 welcome with great enthusiasm practitioners from the health care and campus sectors! The two new tracks include two days of learning sessions addressing sustainability topics specific to these sectors. The Health Care track is a particularly new and exciting expansion for BE. This sector is highly specialized—in its professionals, practices, builders, and operators. Yet certain common denominators of sustainability are universal across the built environment, and BE is an excellent resource for mastering them.

The most fundamental of those common denominators are the laws of nature (not always convenient, I know). Gravity, heat transfer, the interaction between moisture and materials, and the requirements for human health and comfort apply to all buildings. As an applied example, Passive House Institute US (PHIUS) is a repeat contributor at BE, and it was through PHIUS that many practitioners gained a more complete appreciation of the impact of thermal bridging on enclosure performance. Most Passive House projects in the United States to date are single-family homes, but the importance of mitigating thermal bridging is universal in high-performance buildings. At last year's conference, Jim D'Aloisio, a structural engineer from Klepper, Hahn & Hyatt, presented on thermal bridging in commercial buildings, showing through his own projects that it is avoidable through carefully integrated design and construction.

### **Embracing a whole systems approach**

Integrated design, construction, and operations (aka a whole-systems approach) is, then, another common denominator. NESEA's 1970s roots are in solar energy, but over time we have taken a holistic approach to the built environment and its impact on energy resources and the environment (witness our name migration from the New England Solar Energy Association to the Northeast Sustainable Energy Association—conveniently, both "NESEA"). It is difficult to argue against the assertion that, to significantly impact the performance of buildings, practitioners must adopt a whole-systems approach. In health care facilities, especially hospitals, programs and systems are complex. The most successful facilities are likely ones where good integrated design, development, and operations are already occurring; continued improvement is certainly an ongoing challenge.

Successfully applying a whole-systems approach is a daunting task for any project. And health care infrastructure is intense, even overwhelming. A high-performing team of practitioners is paramount and requires cross-disciplinary education—a cornerstone of a whole systems approach. The diverse group of practitioners needs to somehow be unified. Everyone needs to be willing to dance. Engineers dancing with architects dancing with facilities directors dancing with bricklayers, doctors, nurses, and management ... It's not for the faint of heart. But NESEA and BE12 are committed to taking on the challenge. Integrated design, construction, and operations skills are critically important to reversing climate change and stabilizing world energy politics. When you attend BE, you join a growing number of practitioners who understand the power of a whole-systems approach, and you tap into a great resource for cross-disciplinary knowledge.

I sincerely hope that you benefit from the conference far beyond your expectations. If you have suggestions for how we can be better, please let me know.

*James Petersen*  
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# A German City Confronts Climate Change

## IBA Hamburg's holistic plan for generating heat and electricity locally

By Uli Hellweg, Neil Veilleux, and Galen Nelson

### Foreword

Urbanization is increasing across the globe. Towns and cities are now home to over half the world's people. Given the inherent efficiency of cities—greater access to public transit, higher density, and lower surface-to-volume ratios in the built environment—sustainability and clean energy advocates have generally applauded this shift. However, urban areas are also facing greater challenges to sustainability. For example, the Fukushima disaster exposed the vulnerability of low-lying, large-scale energy facilities and the impact they can have on nearby populations. With the onset of global warming—and the increased threat of natural disasters and sea-level rise—sustainable management of building and energy infrastructure is more important than ever to the health of cities.

However, the challenges we face also present important opportunities for city leaders and planners to improve quality of life for local residents and to increase economic opportunities. With this in mind, we are pleased to have a chance to collaborate with Uli Hellweg, managing director of the International Building Exhibition (IBA) Hamburg, who is leading an innovative effort to design and implement sustainability projects that improve quality of life for Hamburg residents.

The opportunities are immense. In Hamburg, for example, planners have developed significant wind, solar, and biogas resources within the city. Hamburg is a leading example of how renewable heating technologies like solar thermal, geothermal, and biomass thermal can be deployed to serve local residents. And as discussed in the article below, the City of Hamburg is using existing local resources and infrastructure to optimize energy production, reduce carbon emissions, maximize resiliency and reliability, and improve the built environment.

The IBA Hamburg project reminds us in the Northeast that although we've made progress on energy efficiency and renewable energy deployment, greater opportunities lie ahead. We have just scratched the surface of renewable heating and district-scale renewable energy projects. Going forward, we need to explore the potential for new policies, business models, and regulatory frameworks to achieve cost-effective, low-carbon, decentralized power production. Ultimately, we are hopeful that lessons learned in Hamburg—and greater trans-Atlantic collaboration—will provide leaders in the Northeast with new ideas and opportunities for increasing sustainable development in our towns and cities.

—Neil Veilleux and Galen Nelson

Across Germany, it is clear to politicians and town planners that climate change is threatening the existence of our planet. Major cities and metropolises stand to suffer most from the impacts of climate change and are also doing the most to cause it. With this in mind, the leaders and citizens of Hamburg have established plans to mitigate the impacts of climate change and simultaneously improve quality of life for residents. These goals have been manifested perhaps most comprehensively as part of the Internationale Bauausstellung—the International Building Exhibition (IBA). IBA Hamburg will highlight what is possible when an entire city district is remodeled to meet environmental and community needs.



A team of architects from Graz, Austria, has designed a building whose facade contains living algae that can be dried and used in a biogas plant.

## Building exhibitions: laboratories for planning

Germany has a long history of building exhibitions: the first was in 1901. International building exhibitions are research and development laboratories for urban planning. They showcase architecture, and even more importantly, they drive innovation in urban development. The IBA designs, develops, and builds projects (with private sector partners) over an eight-year period, culminating in a public exhibition that highlights the economic, environmental, and social benefits of sustainable building projects. IBA Hamburg, the eighth in the IBA series, was launched in 2006, when the Free and Hanseatic City of Hamburg created a special municipal corporation (funded by the city) focused on Wilhelmsburg and the Elbe islands, a district that occupies 35 square kilometers in the heart of the city. With “Cities and Climate Change” as a key theme, it seeks to promote low-impact, carbon-neutral building and energy design, and to make the islands liveable for all parts of society.

The district, inhabited by about 55,000 people, is located where the north and south arms of the River Elbe wrap together. Dikes protect the area from flooding from the river and the North Sea. In 1962, a storm surge breached the dikes. Over 200 people drowned in the chilly waters, and in the aftermath, much of the population left the district. It has since been repopulated by low-income families and newly arrived immigrants. So mitigating the impacts of climate change—like sea-level rise and flooding—has special relevance to Hamburg residents. But IBA Hamburg also aims to address community and economic needs in the district: to create better schools, refurbish and modernize housing, construct innovative new buildings, and create environments that encourage an intercultural urban community.

In total, IBA Hamburg has initiated 40 building projects and some 10 social

and cultural projects. In part, projects are designed to show what the future of modern, environmentally friendly town planning might look like, or to demonstrate how cities could be remodeled to be carbon neutral. Central to this plan is achieving modern standards for building energy efficiency and renewable energy production, which links projects together in a holistic approach to planning.

## Planning for local energy independence

“Future Concept Renewable Wilhelmsburg,” a planning document developed by an international committee of experts and the IBA, establishes a foundation for the energy future of Wilhelmsburg and the Elbe islands. The

ings). Through measures that radically improve the efficiency of existing structures, plus development of local renewable energy resources, the Elbe islands will be able to produce enough power to meet all electric demand by 2025 and all heating demand by 2050.

To improve energy efficiency, Wilhelmsburg must increase its rate of new building and/or renovations from 1 percent a year to about 3 percent. However, while new building energy standards must be aggressive enough to achieve significant energy reductions, it is also important that they remain flexible enough to account for the unique design requirements of the district’s many historic structures. For example, high-rise apartment blocks built in the 1970s will be updated to achieve (or nearly achieve) Passive House stan-



Embraced by the north and south arms of the River Elbe, the Hamburg city district that is the focus of the IBA’s efforts is vulnerable to sea-level rise and flooding.

central idea is to increase the energy efficiency of the district while simultaneously developing local renewable energy resources. To this end, planners developed an “energy atlas” that assesses the energy potential of different types of buildings on the Elbe islands (e.g., if suitable for solar thermal, photovoltaic, or shallow geothermal systems) as well as potential restrictions (e.g., for historic and protected build-

dard. On the other hand, the look and feel of historic buildings in the old part of town will be preserved by applying a less aggressive, though still impressive, energy efficiency performance standard. The typical historic building must reduce energy consumption by about 65 percent, from about 200 kWh/m<sup>2</sup> to about 72 kWh/m<sup>2</sup> annually. For example, the Wilhelmsburger Strasse project renovated a 1920s-era



“Schumacher-style” building to meet the new energy efficiency standards while preserving its historic elements. This was made possible by targeted energy efficiency measures and renewable heating technologies.

In addition, IBA Hamburg will showcase a series of “model house” demonstration projects in Wilhelmsburg. Sixteen model houses for the 21st century will be built, each with an innovative energy-efficient design. For example, Boston-based Kennedy & Violich Architecture will present “soft houses,” which demonstrate how residential buildings can achieve climate neutrality over the entire building life-cycle. SPLITTERWERK, a team of architects from Graz, Austria, has designed a building with a facade containing living algae. The resultant biomass

## Local Renewable heating districts

Another core element of the Renewable Wilhelmsburg concept is decentralized, local district heating networks. IBA envisions supplying local buildings with five district heating networks, of which three are at the planning stage or under construction. Each district heating network builds on local resources and on advantages of its specific location.

The first renewable heating district will be served by a thermal storage unit located in an abandoned World War II-era flak bunker. A buffer storage tank holding 2,000 m<sup>3</sup> (70,629 ft<sup>3</sup>) of water will be installed in the bunker to take up heat from solar thermal units, waste industrial heat, a wood-chip-fired boiler, and a biomethane cogeneration (CHP) plant. When completed,

planning process, IBA commissioned seismic surveys, which revealed promising geological formations. For example, studies suggest that hot water (130° C, or 266° F) is present at a depth of 3,200 meters (10,499 feet), which can likely be pumped out. As a result, experts estimate that up to 70,000 MWth (megawatt thermal) per year will be available for heating. Investigations are also under way to assess the potential for generating electricity from this geothermal resource.

The third heating network creates a “community energy association” of building users. The association supplies central district heating to buildings and also allows decentralized users to feed heat back into the grid. The energy association’s central heating facility—consisting of a CHP plant and gas-fired boiler—guarantees that the annual baseload supply (totaling 5,000 MWth of heating) is available to buildings connected to the grid. In addition, three more buildings within the district will be able to provide heating to consumers and also feed excess heat back into the grid.

The energy association approach mimics the success of the electric feed-in principles enshrined in Germany’s Renewable Energies Act and applies it to heating. Regulations drawn up for the community energy association give decentralized heat exporters priority access to the grid—up to 10 percent of the annual heat requirements. The grid operator pays them a fixed fee for every kilowatt hour of heat that they export, so long as it is generated from renewable sources. The energy association is expected to be extended to other users, at which point the feed-in limit for distributed generators will be increased to 25 percent. Overall, taking into account electricity and heat generation of the system, the energy association is expected to reduce carbon emissions to nearly zero for its members.



Boston-based Kennedy & Violich Architecture’s model “soft house” will show how residential buildings can achieve climate neutrality over their entire life cycle.

can be dried and used in a biogas plant. Similarly, Munich-based Zillerplus Architects is building a Passive House that derives residual heat from a phase-change material (PCM) reservoir, which enables short- to medium-term thermal energy storage. These are just a few of the innovative and experimental designs at IBA Hamburg that are pushing the envelope of sustainable building.

the energy bunker will supply heat to about 3,000 households and electricity to 1,100. The project is expected to reduce carbon emissions by 95 percent—6,600 tons a year. For the first stage of the project, 830 dwellings are being connected to the energy bunker.

The second renewable heating district will utilize Hamburg’s deep geothermal energy potential. As part of the

## Decentralized energy production

In the aftermath of the Fukushima disaster, the Federal Republic of Germany decided to phase out nuclear power. While IBA Hamburg leadership views this as a good move, many worry that the country will replace nuclear energy with other industrial-scale energy sources. As a result, in addition to district heating networks, Wilhelmsburg's renewable energy plan encourages development of other local renewable energy resources. Decentralized systems are considerably more resilient in the face of natural disasters. Moreover, decentralized energy production secures jobs and income for local communities. Both reasons are strong drivers for Hamburg IBA to encourage distributed-generation projects.

To underline this position, IBA Hamburg's concept for Renewable Wilhelmsburg describes a number of approaches for achieving decentralized energy self-sufficiency on the Elbe islands. One particularly compelling project is Energy Hill, developed on a former landfill site. In the 1980s, a toxic waste scandal forced the landfill to close, and the site must now be permanently monitored. At present, a 3.4 MW wind turbine is being installed on the landfill, and this, together with another wind turbine and a photovoltaic array covering one hectare (2.47 acres), will generate 12,400 kWh of electricity annually. That's enough to supply approximately 4,000 households—20 percent of all households on the Elbe islands. In addition, landfill gas from the site supplies a local industrial facility, and shallow geothermal energy heats a visitors' center that provides a history of the transformation of the landfill.


## Building support for the future

To be successful, international building exhibitions must secure the support of local politicians and, most importantly, the people who live in the area. Thus, communication, education, and outreach are core objectives. All



An abandoned World War II-era flak bunker will be both local thermal storage unit—supplying heat to 3,000 households and electricity to 1,100—and public space.

IBA Hamburg projects are reviewed and approved by local residents and representatives through an extensive consultation process. If a project is opposed by a majority of the citizen representatives, IBA Hamburg will not move forward with it. It is essential to discuss with local residents the value and impacts of potential projects. This is particularly true for efforts to make the city more energy efficient. Home owners and tenants must be willing to play an active role, and it has become clear in Hamburg that financial incentives are not enough. People must be convinced on an emotional level that they have a stake in developing a more sustainable future.

IBA Hamburg concludes in 2013 with the official project exhibition. If successful, however, its impacts will continue far into the future, creating structural changes in both buildings and society. 

---

*Uli Hellweg is managing director for IBA Hamburg, overseeing the sustainable development of architectural and social projects.*

*Galen Nelson is the newly appointed director of intergovernmental partnerships at the Massachusetts Clean Energy Center. He previously served as the green tech business manager for Boston Redevelopment Authority. In both positions, he has collaborated with market and policy stakeholders to accelerate the growth and success of clean energy companies, technologies, and products.*

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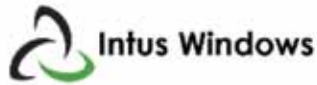
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# Start with the Envelope

## Home insulation is easy and affordable with Mass Save

By Brice Hereford

Since the 1980s, Massachusetts utility companies have levied a monthly one- to two-dollar “energy conservation charge.” This money goes into a pool that helps the state’s home owners improve the energy efficiency of their homes at little to no charge. Why do this? It is less expensive for us to reduce our energy usage than it is to build new power plants. The utility company saves on overhead, and we enjoy all the benefits of reduced fossil fuel consumption.

As the price of home heating fuels continued its slow, relentless climb last winter, I, like others, paid much more attention to my monthly utility statements. A flyer inside my bill from Western Massachusetts Electric (WMECO) invited—no, exhorted—me to take advantage of their free Mass Save Home Energy Assessment, aka an energy audit. I have been audited before and have a healthy dislike for any sort of “audit,” but I can now say this one was like winning the lottery!

The Mass Save program is a great way to save energy and money. It addresses the first steps you should take to insulate your home. While sexy, expensive stuff like photovoltaic cells, geothermal heat pumps, and new windows are important, you should wait on those until you have upgraded the building envelope. It is the best return for your investment, and by doing it first, you will probably reduce the size of your next heating unit.

So how does Mass Save work?

### Audit day

I started by calling to schedule the energy audit. Two weeks later, a techni-



It took two people three hours to seal the gaps in the attic.

cian named Joe came by to do it. Joe had been building for over 30 years and evidently knew his stuff. We began with a questionnaire about the house. Joe needed to know its age (built in 1956 with at least three subsequent additions), square footage (too big), type of heating, etc. When he was satisfied, we started the audit, beginning with the attic.

Climbing around the trusses, Joe poked and pulled at the insulation and examined areas he thought would allow air to leak into the attic from the house. He certainly found plenty. Under the insulation were cracks, gaps, and holes galore from where the recessed cans, exhaust fans, electrical wires, and pipes came through the ceiling.

Joe asked lots of questions and took copious notes as we moved through the rest of the house. He examined the walls to see how thick they were—2x4 or 2x6—and whether they were insulated (and if so, what with). If

your home was built before the 1970s, there is a good chance the walls are 2x4 and uninsulated. In the 1970s, with the Oil Crisis for motivation, house

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The Mass Save program is a great way to save energy and money. It addresses the first steps you should take to insulate your home.

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framing switched from 2x4 to 2x6 construction to leave more space for energy-saving insulation. To check my insulation, Joe removed several switch plates on the outside walls and poked a bamboo barbecue skewer (I kid you

not!) in there to determine whether insulation was present and how thick.

Next, we investigated the basement and the crawl space. There were plenty of cracks, gaps, and holes to be found along the top of the foundation wall, rim board, and anywhere wires or pipes penetrated. Joe told me about the “stack effect,” which causes air to suck upward from the basement,

measurements and sketches of the building’s exterior.

After crunching some numbers, Joe gave me the verdict. He was putting my home in for free air sealing in the attic and a 75 percent subsidy on 6 inches of insulation (R-22) in the attic. My wood-framed, double-paned windows passed muster. With that, Joe left, telling me that a Mass Save office

that energy goes from hot to cold and high to low. So in the winter, air sealing prevents cold penetration and heat escape. That is all the physics you need to know today! Proper air sealing can reduce your heating bill by 20 to 40 percent. It can also reduce the chance of mold in attics, basements, and crawl spaces.

First came a call from Quinn at the local Mass Save affiliate, the Center for Ecological Technology (CET), to explain the process and set a schedule. I was pleased to learn that they were upgrading my package to include free air sealing of the basement, the crawl space, and the garage, as well as the attic!

A week after everything was scheduled and signed for, the sealing crew arrived. The crew, Jesse and Collins, did a walk-through of the areas to be sealed and then got to work. They closed all the doors and windows and placed a large fan known as a blower door in the front door aperture. The blower door forces a lot of air out of the house (15 to 20 times the normal rate, for you technical guys). This allows you to really feel where the air is leaking from. The crew walks around checking for air currents throughout the house, which, when combined with the fan’s readouts, gives them a baseline for comparison once the air sealing is completed.

When the measurements were done, the team suited up in Tyvek suits and air masks and headed for the attic. They applied an orange sealing foam to every applicable surface; anywhere they saw a crack or gap, they sprayed. They were up there for about three hours, and they found way more gaps than I would have thought possible! They even sprayed around the recessed lights and bathroom fans. They used a special fireproof foam/caulk around the chimney. Collins and Jesse were also careful to replace the insulation so that it was fluffed up and working effectively. They then started in on the basement, crawl space, and garage, spraying the orange foam along and



Setting up the blower door to measure airflow and find leaks in the house before sealing.

through the first and second floors, and then out the attic: great in the summer, but terrible for heat retention in the winter.

An energy audit also includes furnace and lighting system checkups. While Joe was unable to assist me with my furnace, he did hand out all the free compact fluorescent lightbulbs (CFL) he had to replace my incandescent bulbs.

The inspection concluded with

would be in touch to schedule the air sealing and insulation. I couldn’t wait!

## Air sealing

Why air-seal? Tomasin at Mass Save explained it to me this way: You insulate a house much like you dress yourself in the winter. Insulation is the down vest that keeps you warm, and air sealing is the windbreaker that keeps the cold air from penetrating. The Second Law of Thermodynamics states



around the rim joists as well as any opening or crack where pipes or wires went through the floor.

Once they finished all the air sealing, it was time to start up the blower door again and see what effect they'd had. We walked around the house feeling to see what the drafts were like in various areas, such as around the windows (not bad), the doors, and the



Checking for outside wall insulation behind an electrical outlet with a bamboo skewer.

crawl spaces under the eaves (bad!). They pointed out areas to focus on and what to do to stop the drafts. Jesse and Collins determined that their efforts that afternoon had reduced the airflow by 12 to 15 percent, which was a good start. Depending upon the age of the house and the quality of the construction, they can get anywhere from 10 to 30 percent. My house was now at a .59 air change per hour, or about one air exchange every 2 hours—12 every 24 hours! I had more to do. That's where the insulation came in.

## Blowing insulation

A few days after the air-sealing procedure, Paul from Co-op Power arrived to add 6 inches of cellulose insulation to my attic. Paul informed me of two very interesting aspects of this insulation, called Cel-Pak. The first was that it was made primarily from newsprint and had an R-value of about 21, which when added to my existing R-30 fiberglass would bring my total insulation

rating to R-50. The second was that it was manufactured locally, by National Fiber in Belchertown, and that much of the newsprint came from local recycling centers. Certainly an added benefit.

Paul and his crew wasted no time getting my attic ready to receive its local insulation. They started by placing propavents between the rafters so the



Taking measurements during the leak-revealing blower door test.

cellulose wouldn't fall down into the soffit and clog it. Most roofs are vented, meaning that air flows in from the eaves, up through the soffit vents, and out the top of the roof through a ridge vent. This keeps the attic cold in the winter to avoid ice dams.

The Cel-Pak insulation came in 40 big plastic-wrapped bales, which Paul and his crew broke apart and fed into a large blower that pushed the insulation through a big, long tube up into the attic at a rate of about one bale a minute. They spread it evenly with the hose and a rake, having tacked up tape measures to make sure they got the right depth.

Through Mass Save, all this was done for about the same cost I would have incurred to rent a blower and buy the supplies.

## Next steps

So what do I do next? This summer I intend to replace my front door with one of those superinsulated polyisocyan-

urate core doors, taking the 30 percent tax credit (check out [www.dsireusa.org](http://www.dsireusa.org) for this and other tax credits and rebates). I will also insulate the crawl spaces under the eaves. At some point, while replacing the siding, I'll add rigid foam insulation to the exterior. Hmm ... Maybe Mass Save will visit me again?

Eventually, I hope to meet Affordable Comfort Inc.'s Thousand Home



An attic full of Cel-Pak recycled cellulose insulation—locally manufactured.

Challenge ([www.1000homechallenge.com](http://www.1000homechallenge.com)), which aims to reduce the energy use of a thousand homes in North America by at least 70 percent. This will take some major efforts, but it is an investment that I know will pay off, because I don't see energy prices going down, only up. 🌐

**Learn more** about Mass Save at [www.masssave.com](http://www.masssave.com) or call toll-free: 866-527-7283. If you are in another state, check with your state's Department of Energy office for an equivalent program.

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*Brice Hereford is a graduate of Boston Architectural College's Sustainable Design Certificate program. His interest in energy efficiency goes back to the energy crisis of the 1970s; his focus is on the building envelope. He is continually upgrading his skill set in building science and how best to integrate code requirements with contractors' abilities. He lives in western Massachusetts.*

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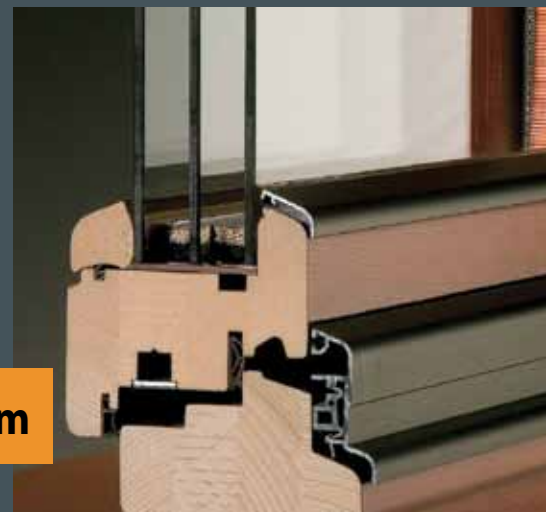
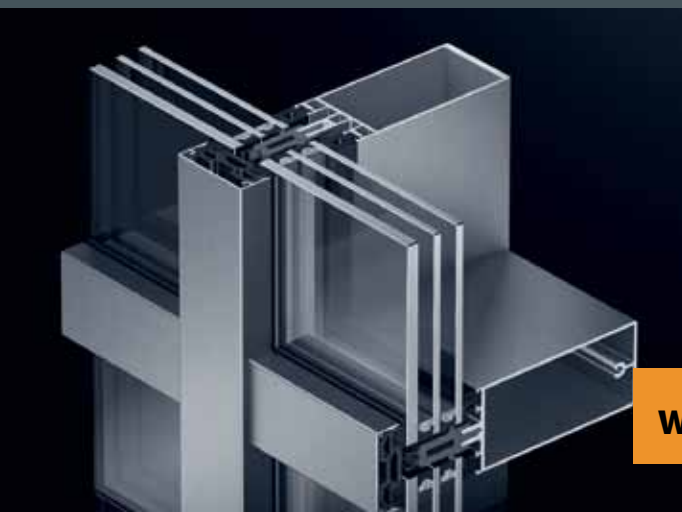
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# Taking Efficiency to Scale

## Massachusetts cities are defining effective practice

By Stephen Burrington

New England has some of the best utility energy efficiency programs in the nation. Massachusetts leads the country in utility spending on efficiency: in 2011, program budgets exceeded \$500 million, triple their previous level. The American Council for an Energy-Efficient Economy, which grades states on building efficiency by looking at utility programs and policies, gave the state first place in its utility category. It also rated Massachusetts the “#1 Efficiency State” overall.

Still, Massachusetts has a long way to go. The state has between 100,000 and 200,000 commercial, industrial, institutional, and government buildings, and 2.75 million dwelling units. Reaching state greenhouse gas reduction goals means upgrading most of those properties. To meet the challenge, it’s essential to ask more than how the utility programs are doing. For example, what are building owners thinking and doing? What are the best ways to influence their actions, and who is best positioned to reach and work with them? Have entrepreneurial forces been unleashed?

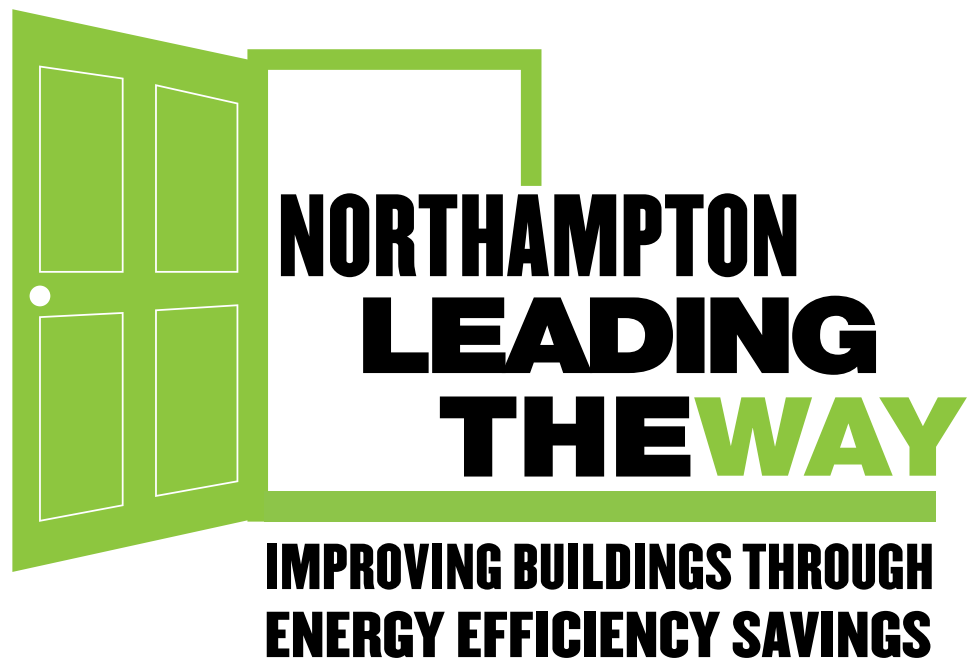
The last decade has seen a diversification of the national efficiency effort. States have created mission-driven “efficiency utilities” designed specifically to improve building energy performance. Starting in cities like Chicago, New York, and Seattle, mayors have promoted, financed, mandated, and/or implemented broad-based building efficiency efforts. Most states have enacted laws authorizing property-assessed clean energy (PACE) finance. A home performance contracting industry has emerged. Nonprofit efficiency firms have grown. Massa-

chusetts cities are paving the way to a future of utility programs embedded in relationships with partners, intermediaries, and entrepreneurs who expand the reach of the effort. From Boston to Pittsfield, local leaders are creating arrangements to engage more building owners and achieve deeper savings. These initiatives are a work in progress. But they have important common elements.

Pittsfield are collaborating with local business organizations and utilities to help firms become more efficient.

### Strategic use of marketing channels

Utility programs are situated in regulated monopolies that historically didn’t have to market aggressively or complete complex sales processes. Their marketing has often been strategic but



Northampton Leading the Way is a community-wide program for achieving energy savings throughout municipal, commercial, industrial, and residential buildings.

### Focus on the commercial sector

Most local energy initiatives have concentrated on the residential sector, single-family homes in particular. But businesses account for most building energy use—in Massachusetts cities, at least two-thirds of it. So city programs in Boston, Newton, Northampton, and

dependent on a limited toolkit. Local energy programs have had more marketing channels at their disposal but haven’t always used them strategically. Now cities are starting to be strategic, developing plans that use social marketing techniques and data analysis.

For starters, they are focusing on target groups rather than broadcast-



David Morrill of the Center for Eco-Technology conducts a walk-through assessment of a business in Northampton, MA, for the Northampton Leading the Way program.



A visit to Boston's Prudential Center led by A Better City.

ing campaign appeals to everyone. To identify prospects, they are tapping assessors' databases, GIS systems, and other data sets. Cities activate their lines of communication, and those of partner organizations, so businesses and residents hear from people they know and trust. Peer influence is brought to bear by property owners or neighbors who showcase energy-saving upgrades. Customer relationship management tools are used to manage the process.

## Facilitation that minimizes hassles

The downside of heavily funded utility programs is that they also are heavily regulated programs. As Massachusetts utilities have gotten better at efficiency, an infusion of funding has been accompanied by an expansion of oversight that complicates their ability to run user-friendly programs and accommodate entrepreneurial initiative. Also, even in Massachusetts, coordination of gas and electric programs is a work in progress. A participating business may need to juggle communications with multiple auditors and contractors. It's possible that none of them will be able to field questions about the whole building, let alone provide information about tax credits and deductions.

In Northampton and Pittsfield, with support from gas and electric utilities, city-led programs offer downtown businesses an "energy concierge" from the Center for Eco-Technology. Boston has a multipronged effort to work with businesses of all sizes: its Green Ribbon Commission engages the largest

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Whether dubbed an energy concierge, one-stop shop, or owner's representative, the facilitation role is vital.

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energy users; leading business organization A Better City provides one-stop service through its Challenge for Sustainability; and the Department of Neighborhood Development works with small businesses. Whether dubbed an energy concierge, one-stop shop, or owner's representative, the facilitation role is vital. The goal is to minimize hassle in the audit and retrofit process and also help businesses adopt and implement multiyear action plans that cover benchmarking, retrocommissioning, building operations, and measurement.

## Whole-building efforts— for leased property too

Originally designed to avoid power plant construction, utility programs have gone farthest in addressing electricity use. Until recently, gas programs played second fiddle, and oil use wasn't addressed at all, although gas and oil account for nearly half of greenhouse gas emissions from buildings. Even in the cold Northeast, thermal energy use in buildings has been neglected. And too little headway has been made in leased property.


City-based programs seek to help building owners upgrade energy performance in a single fuel-neutral effort. In Massachusetts, this means reinforcing utility steps to integrate gas and electric efficiency services. Cities are also tackling the challenge of leased property. In Boston, Northampton, and Pittsfield, city governments have built relationships with commercial property owners in community revitalization initiatives. They have now begun putting those relationships to work on energy efficiency, identifying motivated property owners, coordinating with tenants, setting in motion whole-building upgrades, and showcasing improvements to promote action by others. In Boston, A Better City is working with landlords and tenants to orchestrate efficiency improvements.



In the residential sector, Boston, Greenfield, Pittsfield, Somerville, and other cities are using data and targeted outreach to connect with landlords willing to invest in efficiency. Boston has a full-time landlord coordinator.

## Utility partnerships

To engage more building owners in comprehensive energy improvements, cities need to offer an appealing customer interface and help navigate utility programs and more. Cities can bring new capabilities to bear on challenges utilities face—but only if they are strategic. The shared purpose must be to bring new tools to the job, improve access to what’s working, and fix what, from a business or home owner perspective, is not.

With the spread of local initiatives, the nation is building a more robust attack on energy waste. The day when overall state efforts can be scored lies in the future. But Massachusetts cities, like Massachusetts utilities before them, are starting to define the hallmarks of effective practice now. 

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*Stephen Burrington, a principal of Serrafix Inc. ([www.serrafix.com](http://www.serrafix.com)), helps plan and implement energy, transportation, and smart growth strategies for diverse public- and private-sector entities. He is currently working on EE2020, a foundation-supported program to help Massachusetts cities become leaders in energy efficiency.*

*Reviewer Ben Weil is the extension assistant professor of building energy at the University of Massachusetts. He also provides energy and policy expertise to consulting retrofit firms and public utilities regulators.*

## Resources

Renew Boston: [www.renewboston.org/](http://www.renewboston.org/)

Northampton Leading the Way:  
[www.NorthamptonMA.gov/NLTW](http://www.NorthamptonMA.gov/NLTW)

Powering Pittsfield: [www.pittsfield-ma.org/city\\_departments/parks\\_and\\_recreation/energy\\_challenge.htm](http://www.pittsfield-ma.org/city_departments/parks_and_recreation/energy_challenge.htm)



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# Introducing PHIUS+

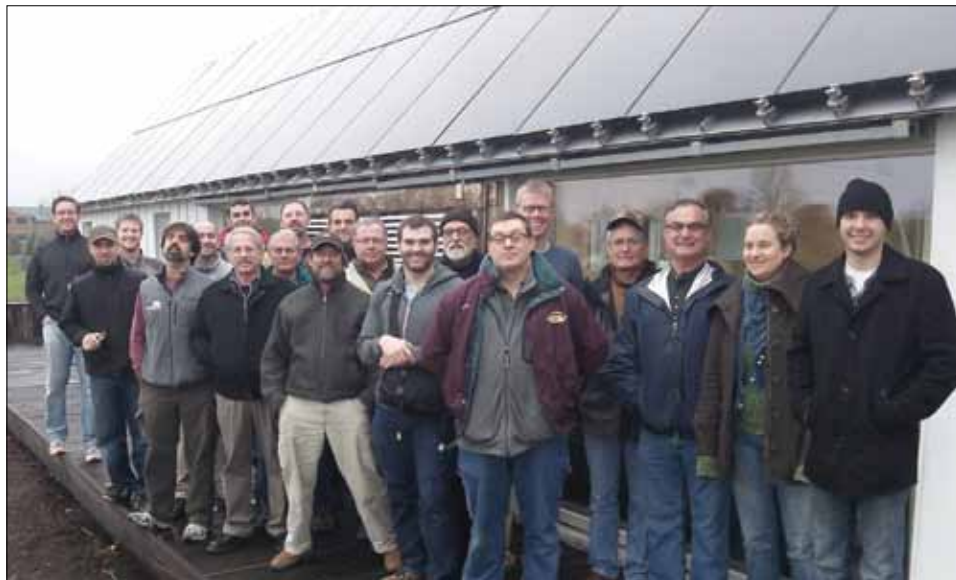
## Aiming for mainstream incentives, the Passive House allies with the HERS

By Michael Knezovich

As Passive House Institute US (PHIUS) looked at the high-performance building landscape entering 2011, there were clearly unnecessary barriers—beyond awareness and understanding—to using Passive House principles and building to the standard. One was that a building team and its client could go to the effort of building a superbly comfortable, ultra-efficient, high-performance building, yet not benefit from any of the incentives offered by utilities or local and federal government for pursuing more mainstream ratings. PHIUS aims to rectify that with a new certification, PHIUS+, that harmonizes with the Home Energy Rating System (HERS) Index.

Awareness and implementation of the Passive House energy standard in the United States have grown dramatically over the past few years. Since its founding in 2007, PHIUS has certified more than 200 consultants, who in turn have built nearly 30 certified Passive House projects. More than 50 other projects are in the certification pipeline. With nearly a dozen training programs in the works for 2012 and new projects being submitted for certification every day, the growth promises to continue.

However, energy incentives are typically keyed to qualification for Energy Star, LEED for Homes, and the HERS Index, which is issued by energy auditors under the auspices of the Residential Energy Services Network (RESNET). PHIUS and the broader Passive House community, including the chapter-based membership organization Passive House Alliance US, have for years been advocating for recognition of Passive House in energy codes



Educating Passive House consultants about RESNET requirements allows them to integrate those specifications into their planning and building processes.

and incentive schedules. That effort continues. Meanwhile, it's only reasonable for buildings that perform so well, meeting or nearly meeting the Passive House metric, to also earn incentives. And so, PHIUS+ was born.

In February 2011, PHIUS and RESNET signed a memo of understanding (MOU) by which they agreed to work together to harmonize the HERS auditing process and Passive House principles. In practice, that has meant looking closely at procedures and at REM/RATE, the software most widely used by RESNET auditors, to adapt the rating process to allow an accurate and meaningful HERS Index to be assigned to a Passive House project. While the new PHIUS+ certification is separate from international Passive House certification, projects still have to meet the performance metrics that are the core of the international standard.

### Passive House principles remain the exception

Passive House design principles, conventions, and construction techniques remain the exception and therefore are not always accurately accounted for. For example, in one test scenario conducted under the MOU, PHIUS discovered ambiguity in terms of inputs related to energy recovery ventilation (ERV). The test example house employs an ERV, a mini-split, and a small baseboard resistance heater as a backup system. Unfortunately, the software made it easy to enter all three as primary systems, dramatically and inaccurately inflating the overall heating requirements. The workaround was simply a matter of backing out two entries as primary systems and accounting for them elsewhere in the model. Every energy modeling and rating approach has strengths and weak-

nesses, and both of these stand to gain from this kind of learning—a bonus of the harmonization process.

Also key to qualifying for incentives is the quality assurance/quality component defined and required by RESNET. PHIUS+ adds mid-construction on-site inspections and expands QA/QC requirements upon completion, thereby meeting the RESNET QA/QC requirements—something Passive House certification alone did not achieve.

The PHIUS+ program should also ease consumers' decision making. Many people are already somewhat confused by the various labels. Some are attracted to Passive House, but they've heard more about LEED or Energy Star. PHIUS+ means they can build to the Passive House standard knowing that if they wish to seek other ratings and qualifications, they can. The scenario is no longer either/or—Passive House or something else.

This is particularly valuable to those who want to build to the Passive House standard but are concerned that it may be a bridge too far in their region and climate. A standing issue is the wide variance of climatic conditions in the United States compared to Europe, where the Passive House standard was developed. As monitoring data comes in from Passive House buildings around the country—from Baton Rouge, LA, to northern Wisconsin, and from Sonoma, CA, to Belfast, ME—it's becoming clear that aspects of the current Passive House metric may need to be adapted to regional climate conditions.

## Pursuing multiple certifications

Until that time, PHIUS+ means developers can seek verification of a project to the Passive House standard while pursuing other certifications geared to a HERS Index. Even if their project misses Passive House metrics, if it meets QA/QC requirements and receives the required HERS Index, it can still earn other ratings, like Energy

Star or LEED, and earn incentives. Previously, there was no alignment of Passive House QA/QC measures with other rating systems, so if a project attempting Passive House fell short, the builders were forced to start from scratch, redoing field verification and performance tests to gain recognition

A key feature of PHIUS+ is Passive House training for current RESNET raters. RESNET-certified raters from around the country traveled to Urbana, IL, last December for special training on Passive House design and construction principles. They also received



Top and above: RESNET raters receiving Passive House instruction at a demo site in Urbana, IL.

in other programs. By the same token, PHIUS is also now educating Certified Passive House Consultants about the RESNET requirements for QA/QC evaluations so they can build that into their planning and construction processes.

instruction on areas of focus that differ from conventional construction, in particular finding and evaluating thermal bridging and inspecting superinsulated wall structures. A full day was devoted to classroom instruction, and a second included on-site visits to the many

Photos courtesy of PHIUS



Passive House projects that have been built in Urbana, IL, home of PHIUS's main office.

## Pilot program off and running

This pilot group will be assigned to rate the inaugural participants in the PHIUS+ program, which was formally launched at the organization's annual conference in Silver Spring, MD, last October. In short, the program will run as follows:

1. A project sponsor—typically a PHIUS-registered Certified Passive House Consultant—will enroll and then upload a specified list of drawings and schedules to the PHIUS certification database.
2. Trained PHIUS consultants will review the plans. The review will include back-and-forth communication between PHIUS consultants and project submitters to tweak plans as necessary.
3. If the plans meet requirements, the project receives precertification status. At that point, a RESNET-certified rater who has also received the specialized Passive House training will be assigned to the project.
4. The rater conducts a second review of the originally submitted plans, performs on-site inspections at important junctures, and completes the final testing, including the blower door and ventilation commissioning protocols.
5. The rater provides full QA/QC reports, which will include certifications and data sought by the submitter—including, if requested, a HERS Index.

PHIUS looks at this as a model for harmonizing standards, rather than having them compete. PHIUS is pursuing similar efforts with regard to LEED for Homes as well as the Earth Advantage Institute's Energy Performance Score. For example, with LEED for Homes, meeting the American




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Society of Heating, Refrigerating, and Air-conditioning Engineers' 62.2 local kitchen exhaust requirements without overdimensioning other ventilation flows has been considered an obstacle to achieving Passive House certification. However, working with Asa Foss, the national LEED for Homes technical director, LEED-H teams also pursuing Passive House have developed several successful strategies for meeting both standards. For example, ERVs and heat recovery ventilators can be sized and set so that in boost mode the LEED-H 100cfm intermittent requirement is met. In some cases this may require airflows to be temporarily diverted entirely to the kitchen.

This kind of cooperation is accelerating for good reason: it leverages the awareness and acceptance of standards, processes, and labels that are better established in the United States

than Passive House, thereby removing a barrier to bringing Passive House from movement to mainstream. 

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*Michael Knezovich is director of communications at PHIUS. Michael has worked in journalism, technical writing, and training development and managed marketing communications at Spyglass Inc., an Internet software company.*

*Reviewer Paul Panish holds a BS and an MS in electrical engineering from Carnegie Mellon University. He is a Certified Passive House Consultant, a RESNET-certified Energy Rater, a principal in the DEAP Energy Group, LLC, and Advanced Building Analysis, LLC, and a board member of Energy Raters of Massachusetts Inc.*

# Cohousing for Veterans

Principles of community and shared resources aren't just sustainable: they support the transition to civilian life

By Yoomie Ahn and Laura Fitch

As the Iraq and Afghanistan wars wind down, advocates for veterans are thinking about ways to ease the transition from military service to civilian life. In all likelihood, soldiers now serving the country will be let go at a time when the economy is still struggling and jobs remain scarce. Transition may be further complicated by post-traumatic stress disorder (PTSD), physical injuries, and the need to reestablish interrupted relationships with family and friends. Cohousing with an emphasis on community principles and shared resources could be a holistic way to provide much-needed support as veterans retrain for private sector jobs, obtain educational degrees, and return to civilian and family life.

Cohousing is an innovative housing model that brings people together through active participation in the design and operation of their neighborhoods. There are now over 115 cohousing communities thriving in the United States. Most are designed to be "green," with well-insulated, clustered homes. Residents enjoy privacy within their individual homes and community at their doorstep. There's usually a common house, which typically includes a large multipurpose dining room, a kitchen, guest rooms, a workshop, and meeting and exercise rooms. Regular social contact comes from sharing in optional group meals and meeting on a regular basis to discuss the work of managing and maintaining the community. A recent survey of 81 cohousing communities also showed a preponderance of social support systems: men's and women's



The Gordon H. Mansfield Veterans Community in Pittsfield, MA, serves once-homeless veterans. Developed by the nonprofit Soldier On, it looks a lot like cohousing.

groups, informal and formalized child care swaps, lending and borrowing of everyday items, etc. Combine all this with specific veterans' services, and veterans' cohousing makes a whole lot of sense.

However, cohousing has been

criticized for not being affordable and accessible enough—and true sustainability embraces socioeconomic considerations as well as environmental ones. Determined to address these concerns, the Cohousing Association of the US (Coho/US) recently connected



with Soldier On, a Massachusetts nonprofit developing affordable housing for returning and/or homeless veterans.

Soldier On's mission is to fill the gap between veterans' health services and homeless shelters and to help soldiers reclaim their lives and their place in the community. The organization recently developed a nationally

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Cohousing with an emphasis on community principles and shared resources could be a holistic way to provide much-needed support as veterans retrain for private sector jobs, obtain educational degrees, and return to civilian and family life.

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acclaimed community-based model for providing permanent housing for previously homeless vets: the Gordon H. Mansfield Veterans Community in Pittsfield, MA. Soldier On's communities, says architect and Coho/US board member Laura Fitch (coauthor of this article), "look a lot like cohousing, with clustered homes, a pedestrian walkway, well-insulated units (certifiable to LEED Silver), and solar panels with a de facto common house at the transitional housing project on the same site." Cohousing's emphasis on front porches and pedestrian walkways creates the framework for spontaneous social interactions. For veterans' housing, the common house could provide all the typical functions, plus support groups and health services.

"The element that most characterizes the operations of Soldier On is the quality of social interactions," says Kate DeCou, director of development and analysis with Soldier On. "Each

person thrives in an environment that is caring, safe, and secure." DeCou believes PTSD may be best addressed in a community where "these conditions help restore a relaxed, non-stressful level of functioning that permits other cognitive and relational skills to be activated. There is a tendency to lean on the caring support offered by peers, and debilitating isolation is avoided."

While successful cohousing comes in many forms (urban, rural, multigenerational, senior-only, new construction, renovation), veterans' cohousing might ideally be situated near veterans' health care facilities on donated or ground-leased land from the US Department of Veterans Affairs or local government entities. It might also be part of a neighborhood stabilization project—putting money into neighborhoods with high foreclosure rates.

Following the annual national cohousing conference in Washington, DC, last June, several leaders in the cohousing movement met with congressional staff to advocate for cohousing as a way to meet the myriad socioeconomic and environmental needs of their constituencies. They noticed that the ears of meeting participants perked up when they discussed the relevance of cohousing to various demographic groups in need of support—specifically, returning veterans and their families.

The next step—one we hope this article will help inspire—is for cohousers, nonprofits serving veterans, and veterans themselves to start planning affordable veterans' cohousing projects. ♻️

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*Yoomie Ahn is a development advisor with the low-income housing tax credit investor Virginia Community Development Corporation in Richmond, VA. Laura Fitch is a principal with the architectural firm Kraus-Fitch Architects Inc. in Amherst, MA. To learn more about cohousing, see the National Cohousing Association website at [www.cohousing.org](http://www.cohousing.org). To learn more about Soldier On, see [www.wesoldieron.org](http://www.wesoldieron.org).*

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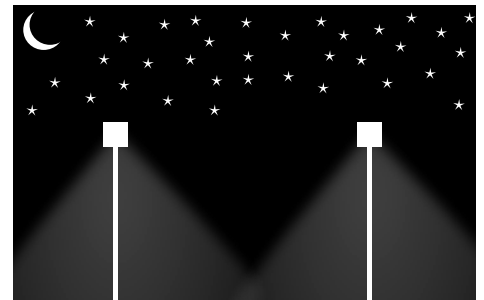
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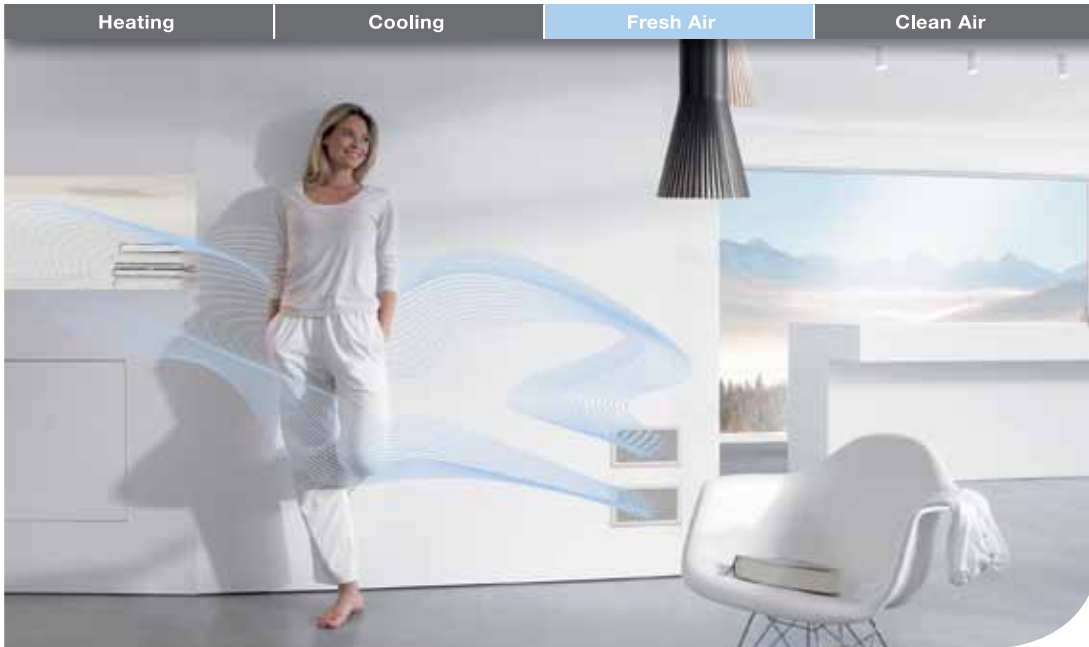


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# BuildingGreen's Top 10 Products for 2012

## Innovative solutions for energy efficiency, reduced toxicity, and retrofits

By Alex Wilson

There are more “green” building products than ever, but not all of them address a real need. Worse, some of them may create new problems down the road. Now in its 10th year, BuildingGreen's Top 10 recognizes the products that represent important, quality green building innovations for the year ahead. The products are drawn primarily from new additions to BuildingGreen's *GreenSpec Directory*, which selects products based on rigorous criteria developed over 20 years.

In choosing this year's Top 10, BuildingGreen looked for companies that solved pressing needs in energy efficiency, reduced toxicity in building materials, enhanced retrofit applications, and offered unique solutions in other areas. Multiple environmental attributes, such as durability combined with low toxicity, remained a key frame of reference. The US Green Building Council's LEED (Leadership in Energy and Environmental Design) Green Building Rating System continues to be a big driver in the development of green products, spurring manufacturers toward market transformation.

For more in-depth reviews of the Top 10, see the *GreenSpec* email newsletter or BuildingGreen's *Environmental Building News*—the oldest newsletter in the field. Neither carries advertising.

### Ductless heat pumps and VRF systems with tenant submetering

Mitsubishi Electric

*What makes it green?*

- Conserves energy and manages loads
- Alternatives to ozone-depleting substances



These split-ductless and VRF (variable refrigerant flow) air-source heat pump systems supply efficient heating and cooling for residential and commercial applications. They comprise outdoor condensers, controllers, and interior air-handling units supplied by lines carrying ozone-safe R-410a refrigerant. In recent years, Mitsubishi Electric has been at the leading edge of the air-source heat pump revolution. Their efficient systems significantly

outperform older unitary heat pumps, especially at low outdoor temperatures in which air-source heat pumps have not been practical. The residential M-series models are available with SEER ratings as high as 26. Some are available with wireless controls and Mitsubishi's Hyper-Heating Inverter (H2i) technology, allowing operation at outside temperatures as low as -13°F (-25°C). For multifamily application, the company's VRF systems can be configured with “tenant billing.” A single outside unit can serve up to 50 individual zones, with total electricity consumption apportioned for separate billing to tenants according to the heated or chilled air delivered by the indoor units. [www.mitsubishielectric.com](http://www.mitsubishielectric.com)



The vast majority of carpet today is treated with fluoropolymers (perfluorinated compounds, or PFCs) for stain resistance. PFCs do not readily break down in the environment, and their long-term health and environmental impacts are unknown. The US Environmental Protection Agency and other agencies worldwide are investigating them as potentially hazardous. Most InterfaceFLOR carpet tiles come standard with non-PFC-treated fibers. They are also available with GlasBac RE recycled PVC backing that contains at least 74 percent recycled content and is certified to NSF 140-2007e Platinum. The carpet tiles are Green Label Plus certified, meet ASTM E2471, and were the industry's first carpet with post-consumer recycled content type 6.6 nylon fiber. These products can be

### Carpet tiles with non-PFC carpet fibers

InterfaceFLOR

*What makes it green?*

- Post-consumer recycled content
- Pre-consumer recycled content
- Releases minimal pollutants
- Reduces pollution or waste from operations

installed using InterfaceFLOR's Green Label Plus low-emitting adhesive options—Grid-Set Green Glue 2000, Grid-Set 2500, or the TacTiles installation system. [www.interfaceflor.com](http://www.interfaceflor.com)

## Aqua2use gray water system

Water Wise Group Inc.

*What makes it green?*

- Conserves water



The Aqua2use system collects water from the shower, laundry, lavatory sinks, and bath and channels it through

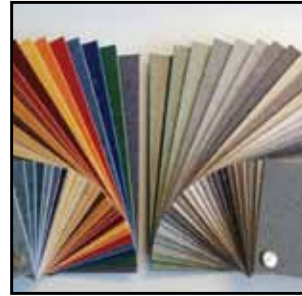
a four-stage filtration system into a 21-gallon high-density polyethylene (HDPE) tank to create water suitable for outdoor irrigation. When the tank is filled, the system's control box automatically triggers the pump to distribute the water to irrigation lines. These systems can also be configured in some situations without a pump, relying on gravity flow. The reusable filters have a 15,000-gallon capacity and should be cleaned every four to six months, depending on use. [www.waterwisegroup.com](http://www.waterwisegroup.com)

## Lifeline PVC-free resilient flooring

Upofloor Oy

*What makes it green?*

- Alternatives to hazardous components
- Releases minimal pollutants
- Exceptional durability or low maintenance



Manufactured by the Finnish company Uponor and distributed in the United States by Altro Floors as the CS Line, Lifeline resilient flooring is made for heavy-traffic commercial spaces. Dirt cannot penetrate its surface, so it requires minimal maintenance. Yet it contains no PVC, plasticizers, phthalates, halogens (including chlorine or bromine), or heavy metals. Made primarily from limestone, along with an ethylene/methacrylic acid copolymer thermoplastic resin binder, Lifeline has an ionomeric wear layer similar to a golf ball cover that is resistant to a wide variety of chemicals and disinfectants. It is certified as low-emitting by Floorscore and by Finland's Building Information Foundation, which gave it an M1 rating for best-in-class, low overall life-cycle emissions. Lifeline is available in sheet form (tiles are available in Europe) and in a variety of colors and patterns. [www.altrofloors.com](http://www.altrofloors.com)

## Cl-Girt rain screen system

Knight Wall Systems

*What makes it green?*

- Reduces heating and cooling loads
- Exceptional durability or low maintenance



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Photo: Ed Wonsek

[www.hmfh.com](http://www.hmfh.com)



This commercial rain screen framing system installs over rigid board insulation to create a continuous insulation system in steel-framed buildings (a minimum 25 psi compression strength is required). Conventional systems attach to the steel frame with metal clips; to create an exterior insulated system, the rigid insulation has to be hand-cut around each clip. The CI-Girt system, however, is screwed directly through the insulation into the steel frame. Installation time is reduced, and there is far less thermal bridging through the insulation, allowing the system to meet the American Society of Heating, Refrigerating, and Air-conditioning Engineers' definition of "continuous insulation." The CI-Girt incorporates all the component parts of a rain screen system—including cladding—and can accommodate up to 4 inches of exterior rigid foam insulation. Cladding options include thin brick, metal, composite, and terra-cotta panels. The CI-Girt system is marketed by Dow Chemical as the Dow-Knight CI-System when used in conjunction with the company's Thermax rigid foam insulation. [www.knightwallsystems.com](http://www.knightwallsystems.com)

## Analog-to-digital wireless thermostat and other controls

Cypress Envirosystems

*What makes it green?*

- Conserves energy and manages loads
- Reduces heating and cooling loads



Cypress Envirosystems offers analog-to-digital wireless controls for com-

mercial thermostats, lighting, and other equipment. The systems allow older controls to be managed remotely for significant energy savings. Engineered for retrofit applications, the company's Wireless Pneumatic Thermostat (WPT) lets you wirelessly control set points for daytime zone and night setback temperatures without having to change out pneumatic pipes, run wires, or open up walls or ceilings. These thermostats have options for integrating them into building automation systems and can be used for utility demand response programs. Lighting controls and wireless monitoring systems for air handlers, chillers, and boilers are also available. These products install in a fraction of the time of a full digital retrofit, with installation performed by Cypress-certified installers. [www.cypressenvirosystems.com](http://www.cypressenvirosystems.com)

## EonCoat waterborne ceramic coating

*What makes it green?*

- Releases minimal pollutants
- Reduces impacts from construction or demolition
- Exceptional durability or low maintenance



EonCoat is a durable two-part waterborne ceramic coating that sets almost immediately to form a dense, protective barrier on steel, aluminum, interior or exterior masonry, wood, wallboard, and many other substrates. It contains no VOCs and no hazardous air pollutants

(HAPs) and has a flame spread of zero without the use of flame retardants. Appropriate for commercial and industrial use, the two-part coating—phosphoric acid and magnesium hydroxide (aka milk of magnesia)—is mixed in the spray valve during installation, so no mixing pots are required. EonCoat dries in minutes and can produce a variety of architectural finishes in a wide range of colors. It can be installed over metal surfaces with only minimal treatment to remove flaked paint—no sanding down to bare metal, no primer coat. [www.eoncoat.com](http://www.eoncoat.com)

## Ritter XL Solar solar thermal system

Regasol USA

*What makes it green?*

- Renewable energy



Ritter XL Solar combines three unique technologies—advanced evacuated tubes, compound parabolic reflectors, and water as a heat-transfer fluid—to create large-scale compound parabolic concentrating (CPC) solar thermal systems for use in commercial, multifamily, or industrial applications that have high hot-water demand. Distributed in North America by Regasol USA, Ritter custom designs the XL systems so they are able to use water, which is very efficient at transferring heat energy, rather than glycol, which is more commonly used to prevent freezing. Using water also simplifies integration of the system into the building network. These complex systems use Ritter's

sophisticated Aqua controller and can provide high-temperature water year-round, even in cold climates.

[www.ritter-xl-solar.com](http://www.ritter-xl-solar.com)

## Philips EnduraLED lightbulbs

Philips Lighting

*What makes it green?*

- Conserves energy and manages loads
- Improves light quality
- Exceptional durability or low maintenance



The Philips EnduraLED A19 was engineered as a replacement for the 60-watt incandescent lightbulb and is the first such LED bulb to be Energy Star qualified. It is fully dimmable, has an average rated lifespan of 25,000 hours, and comes with a three-year limited warranty. When turned off, the EnduraLED has a unique yellow appearance due to the phosphors, but once turned on it casts a warm white light with a 2700K color temperature—similar to that of a typical 60-watt incandescent. This bulb is currently available in a 12.5-watt version with a color rendering index (CRI) of 80. But a new 10-watt version with a CRI of 90 should be available in 2012. The 10-watt recently completed 18 months of testing to become the first winner of the US Department of Energy's Bright Tomorrow Lighting Prize (L Prize). The prize is awarded to an LED that meets performance metrics for light quality, color, and output. Philips also makes 40- and 75-watt incandescent-equivalent bulbs. [www.lighting.philips.com/nam.com](http://www.lighting.philips.com/nam.com)

## AllSun Trackers

AllEarth Renewables

*What makes it green?*

- Renewable energy



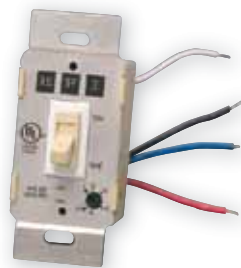
The AllSun Tracker combines photovoltaic collectors, inverters, and controls with a ground-mounted, dual-axis tracker that uses GPS to precisely follow the sun across the sky to maximize the amount of light hitting the panels. Upon "waking" in the morning, the panels tilt north to dump accumulated snow, and in high wind they move to a "stow" position parallel with the ground to minimize wind resistance. The

*continued on page 39*



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# Solar Hot Air: A Heating Revolution

## A New Hampshire company propels this new technology with new financing

By Jim Cavan

Solar hot air technology is poised to redefine how we think about heating large buildings. And here in New England, where upwards of 85 percent of homes are heated with fossil fuels—and where clean, green heating alternatives have traditionally been hard to promote—Revolution Energy is taking the lead on both installing and financing this promising technology.

The Dover, NH, company has installed nearly a half dozen solar systems since its 2008 launch, becoming the single largest owner of online solar equipment in the state. As such, they are expert in both standard alternative energy systems and lesser-known but burgeoning technologies like solar hot air. They're betting that solar hot air will become a game changer in their ever-changing industry.

### A sleeping giant

Think of a hospital or any building that needs a constant flow of fresh air. Typically, it draws in cold air during the winter months—air that must be heated up to room temperature. That, in turn, requires more oil or propane. Well, imagine if you could connect a solar array directly to the existing fresh-air intake, so that you'd be taking in air that was already warm, thereby reducing your use of fossil fuels—and your heating bill. "The true payback or savings for a system like this would be in a reduction of oil use of twenty or thirty percent," notes Mike Behrmann, a principal at Revolution. "This technology really is a sleeping giant."

The technology is as straightforward as it is effective. Solar collector

panels are typically mounted on the outer walls (the roof, slightly more expensive, is also an option). Sunlight then feeds into the panels, just as it

large-scale PPAs around the state, including at Exeter High School and East Kingston Elementary School. "Just as oil or propane can be delivered to your

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While solar hot air has become more recognizable in recent years, it's the financial mechanism behind the system—a "power purchase agreement"—that's the real coup.

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does with a standard PV or hot water array, moving through rows of perforations before being fed through a fan and ventilation system that helps force the air into the building. The result is not so much a stand-alone heating system as it is a dependable augmentation—a way to bring enough "free" heat into the building to significantly reduce the need for fossil-based fuels.

While solar hot air has become more recognizable in recent years, it's the financial mechanism behind the system—a "power purchase agreement"—that's the real coup. A power purchase agreement (PPA) lets buyers purchase energy generated on-site from a third-party partner (in this case, Revolution) without a significant up-front capital investment. The actual equipment, as well as any subsequent maintenance, is handled by the contracted company (again, Revolution). The terms can be adjusted depending on the project; monthly, bimonthly, and annual payments are all common. To date, Revolution has initiated several

home or business," Behrmann explains, "we're generating thermal energy through a collector and delivering it to you right on-site. So not only are we cutting out the transportation aspect of it, but it's something that's being created on your property."

### The world's first PPA-inspired system

Sanborn Regional High School in southern New Hampshire is the first test case for the combined technology and financing mechanism. Not the first in the state. Not even the first in the country. The first in the world. Last fall, the town board unanimously approved moving forward with the project, a PPA between Revolution and their distributor having been signed.

The panels themselves will be provided by Enerconcept, a Quebec-based firm specializing in solar heating technologies. Launched in 1998 as a purveyor of all things renewable—solar PV, wind, geothermal, you name it—by

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2002 the company had begun honing in on non-residential solar hot air and is now one of North America's foremost providers of the technology. After great success in their native Canada, Enerconcept was eager to expand their operations into New England (through US-based Shift Energy), where new forms of energy had managed to make significant headway in the wake of renewable-energy incentives. Enter Revolution Energy and their unique financing mechanism. The partnership between Revolution and Enerconcept will be officially consummated when Sanborn Regional High School's system goes online.

The world's first PPA-inspired solar hot air system promises to be as game changing within the school district—and in the classroom—as in the world of alternative energy writ large. "The school district is incredibly excited," exclaims Carol Coppola, Sanborn Regional School District's business administrator. She happens to know Revolution principal Clay Mitchell from back when the two worked for a private firm called Municipal Resources. "It's a great opportunity for the school district, and we're all looking forward to the start of construction as well as developing the educational component."

It's a sentiment Mike Behrmann wholeheartedly echoes. "Our demand for energy is continuing to increase, along with our reliance on fossil fuel," he says. "We must adjust the current prism we view our energy habits through and become open to a more sustainable, independent, and reliable energy future. We see our work as one of many ways we can reach this energy future, and we are proud to help push that frontier forward."

*Jim Cavan is the director of Media for Green Alliance. Based in Portsmouth, NH, the organization helps certify and promote sustainability-minded businesses throughout the region.*





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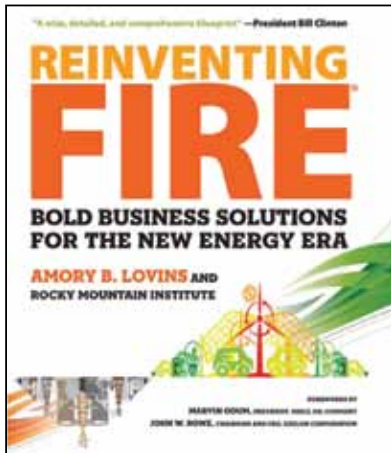
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## Reinventing Fire: Bold Business Solutions for the New Energy Era

Amory B. Lovins and Rocky Mountain Institute  
Chelsea Green Publishing, 2011

By Mitch Anthony

“Reinventing Fire” is an audacious but appropriate title for the new book from Amory Lovins and the brain trust at Rocky Mountain Institute. Amory and his band of brilliants not only make the ultimate case for a completely new energy paradigm, but also show us how to build a brand-new, post-oil economy to go with it. *Reinventing Fire* is, as they put it, a “road map for navigating the United States’ economy through the end of the fossil-fuel era.”

Ever since there’s been something called alternative energy, there’s been Amory Lovins. The first to explain energy as a whole system, the first to see the hybrid car as inevitable, and one of the first to show the pure economic case for sustainability, Lovins is expert at making an accountant’s case for positive futures. And at Rocky Mountain Institute (RMI), which he cofounded, he’s surrounded by a team of people who think as big as he does. Since 1982, they’ve been think-tanking how to “drive efficient and restorative use of resources” by 1) transforming design, 2) busting barriers, and 3) spreading innovation. Right. I’m a sucker for this kind of thinking, so when RMI offers a

road map, I’m open.

A textbook format lends itself well to an Amory-brand idea. Big, wide pages allow plenty of documenting and supporting words. Trends and data points are represented as charts and graphs. Sidebars introduce related concepts in context. It’s a bright and colorful schoolbook of facts, figures, and probabilities. The same format also allows a potentially overwhelming topic to be filtered through easy-to-grasp chapters. The shifting energy landscape is just easier to understand when considered through the primer lenses of “Fuels,” “Buildings,” “Industry,” “Transportation,” and “Electricity.”

But to me the real value in this addition to the Lovins canon is found in the closing essay, “Many Choices, One Future.” Here again, the textbook layout serves the reader well—this data is not necessarily linear. Poke around. Start your read, for example, on page 229. By then, team Amory is in full visioning swing. By the end of the book, building on the credibility they’ve earned with page after page of documentation on the best way forward to an economy just crying to be birthed, they’re promising a day 50 years in the future when my house is a true asset. No longer does it suffer “chills and fevers, nor does it need yesteryear’s noisy, costly mechanical equipment.” Better yet, my “Intergrid service provider” is paying me for energy made by my rooftop tiles and car.

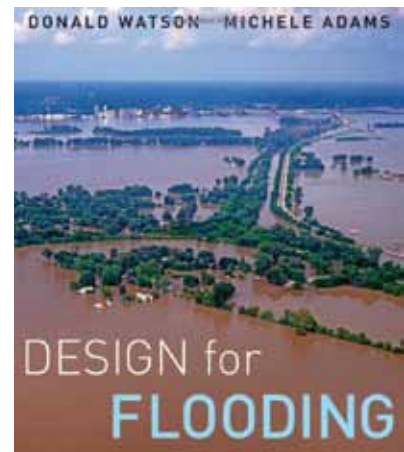
This is Amory at his best. From the tops of the Rockies, he and his seers have a delightfully rosy view of tomorrow. But because these are Amory-brand ideas, they are built on the bedrock of great data. The first five chapters make such a tight business case that this all-is-well world of cybernetic comfort and opportunity looks as certain to happen as the Prius.

Anybody in our still oil-based economy, no matter their business, will find reason to consult *Reinventing Fire* regularly. It’s encyclopedic about true

costs and hopeful in its forecasts. It would make a great resource for scenario planning. Buy it for your office. Read it to put a rudder into the rough seas of economic evolution.

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*Mitch Anthony, a strategic consultant to NESEA, calls himself a facilitator, discoverer, and cat herder. He’s a systems thinker who uses design and branding processes to improve organizational effectiveness.*



## Design for Flooding

Donald Watson, FAIA, and Michele Adams, PE,  
LEED AP  
Wiley, 2010

By Joel Gordes

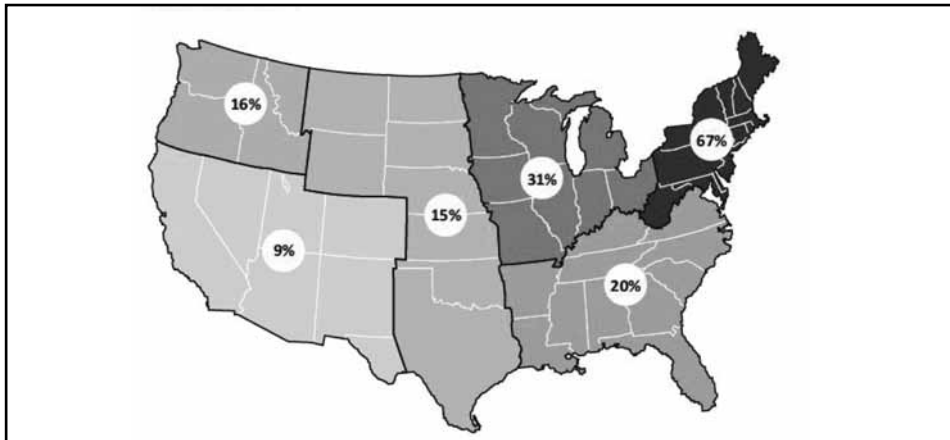
This book ought to be on the desktop of every NESEA professional. At a time when the word *green* has become almost synonymous with obtaining a LEED certification or slathering a building with photovoltaics, *Design for Flooding* goes to the heart of true sustainability. In addition to promoting environmentally sensitive designs, the authors caution that buildings must be appropriately located and built to better sustain the ravages that man and nature can inflict. That is, to be resilient. And they go on to show us how.

The authors are eminently qualified to write on this subject. Lead author Don Watson is former chair of the Yale

School of Architecture Environmental Design Program and former professor and dean of the School of Architecture at Rensselaer Polytechnic Institute. Complementing him is coauthor Michelle Adams, an engineer and water resources engineer. Watson, for those of you new to the field, is no stranger to being ahead of emerging trends. By 1977 he had already designed or consulted on over 80 solar houses and written three books that helped launch

that most likely can prevent the same results when the next, possibly even more intense, event occurs.

For fans or students of whole systems thinking, here it is at its best. The book goes into not only the interactions within and between components of a building and its microcosm, but also the macro realm, where buildings and populations interact and respond to complex, changing (via both natural processes and human error)



Downpours that can cause flooding are becoming more frequent. This map shows percent increases in the amount of rain falling in very heavy precipitation events (meaning the heaviest 1 percent of all daily events) from 1958 to 2007. The trend is particularly pronounced in the Northeast, with a 67 percent increase in the amount of rain that came down in such events.

a generation of architects, engineers, and designers along this path.

The book is extremely timely, having been published about six months before tropical storm Irene, which devastated the Northeast. Watson and Adams cite Gulf Coast hurricanes Katrina and Ike as cases where surge and wind impacts exceeded building codes and prior planning assumptions. They include the New Orleans Principles, which came out of the US Green Building Council, and detail the concept of passive survivability—espoused by NESEA's former executive director, Alex Wilson. If any single message comes across, it's that rebuilding the same types of structures in the same locations and in the same way should not be an option: nature always wins when we repeat imprudent actions. This 300-page volume provides alternatives

environmental factors. It collects many examples of treatments that alleviate the impacts of flooding. For example, landscape design, breakaway walls, flood vents, and, along shorelines vulnerable to storm surges, deep setbacks. (I never knew there were seven types of breaking waves.) It also draws upon biomimicry, discussing how we must better apply the lessons of nature in our landscape design, building design, and construction techniques. One of the more interesting points the authors make concerns green roofs, the value of which has been the source of some debate in NESEA conferences. While Watson and Adams say little about any direct energy savings, they do go into some detail on the value of slowing the release of intense rainfall that might otherwise immediately run off and exacerbate flooding. For this

alone, those who have opposed green roofs might reexamine their positions.

For the reader who has no previous exposure to environmental studies or science-related courses, this book is a blessing. It provides just about everything required for deep knowledge in one convenient location. The topics are too numerous to detail here, but they include weather, land and water cycles, the nature of flooding, and designing with water in mind (inland and coastal), finishing up with designing for resilience. Its glossary, too often ignored in many books, is very complete. Also adding value are 30 pages of case studies and proposals for locations around the globe, each with its own particular needs, vulnerabilities, and solutions. Especially appreciated are the many diagrams, photographs, charts, tables, and sidebars. Some chapters are so visual that little text is needed.

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For fans or students of whole systems thinking, here it is at its best. *Design for Flooding* goes into not only a building and its microcosm, but also the macro realm.

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Finally, the authors unabashedly, matter-of-factly explain climate change and even argue for its anthropomorphic origins. Regardless of what the reader may think about climate change, the ample empirical data presented here show two things: 1) there have been changes, be they natural or anthropomorphic in origin, in certain weather-related events that require a rethinking of where and how we build (see the map, compiled from NOAA data); and 2) due to increasing population in coastal areas in structures originally built for seasonal use only, the fre-

quency, impact, and cost of disasters will increase for individuals and the nation as a whole. With these in mind, the design and building community, as well as those engaged in code and environmental law and enforcement, would do well to use *Design for Flooding* as a guide for amending present standards and setting new ones.

A NESEA member since 1976, Joel Gordes has designed or aided in the design of over 200 passive solar homes. Today he is involved in environmental- and energy-security issues aimed at redesigning the electric grid for greater resilience.

**Building Green's Top 10 Products for 2012**  
*continued from page 32*

company claims the system helps produce up to 45 percent more energy than a fixed system. AllEarth Renewables' Series 20 system, for smaller residences, is rated at 4.2 kW (peak), and its Series 24, designed for larger residences or small businesses, is rated at 5.5 kW. In the northern Vermont climate, these systems should deliver about 5,900 kWh and 7,700 kWh, respectively. These grid-tied systems are 22 feet wide and either 18 or 20 feet high for the Series 20 or 24 model, respectively. AllSun Trackers

come with a 10-year warranty on the entire system, including inverter, and a 25-year warranty on the collectors.  
[www.allearthrenewables.com](http://www.allearthrenewables.com)

Alex Wilson is the founder of BuildingGreen ([www.buildinggreen.com](http://www.buildinggreen.com)), which celebrates 25 years in business this year, and executive editor of GreenSpec and Environmental Building News. He is the 2010 recipient of the Hanley Award for Vision and Leadership in Sustainable Housing. He was NESEA's executive director from 1980 to 1985.



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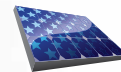
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